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UNITED STATES PATENT APPLICATION

FOR

**UNITARY MOLDED LENS FILTER FOR
TOUCH SCREEN INTERFACE**

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CROSS-REFERENCE TO RELATED APPLICATIONS

Not Applicable.

STATEMENT REGARDING FEDERALLY SPONSORED RESEARCH OR DEVELOPMENT

Not Applicable.

REFERENCE TO A MICROFICHE APPENDIX

Not Applicable.

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a unitary molded front cover lens filter for a touch screen interface with an associated process control device. In particular, the present invention incorporates a front cover that provides a watertight seal for a sensing control device, especially against bursts of high pressure water, while enabling operator input through a sensor adjacent a display screen. Known art may be found in U.S. Class 345, subclass 175 as well as in other classes and subclasses.

2. Description of the Prior Art

Many types of automated control systems, computer controlled systems and hybrids thereof have evolved through the years to dominate the manufacturing and processing industries in this country. Such systems have literally revolutionized industrial production and increased the speed and productivity of the average worker in this country.

One common type of these computer systems permits an operator to interactively control manufacturing and/or industrial and/or other processes by entering information into the computer during such processes to thereby control the process. Some interactive systems facilitate this operator control by permitting the operator to evaluate status information shown on a display screen, such as a cathode ray tube or liquid crystal display or any other associated display device, and then selectively touching points on the screen to interact with the system. Such interactive systems have become increasingly prevalent in most major food processing plants.

1 An example of a common interactive touch input system is one that provides an
2 arrangement of radiation or infrared emitters and corresponding detectors in pairs. That is, a line of
3 infrared light emitters are usually arranged along two adjacent sides (i.e. one vertically and the other
4 horizontally abutting) along the outer periphery of the display screen with the other line of detectors
5 arranged oppositely. Other types of sensors are available as well, including acoustic and optical that
6 work similarly.

7 This arrangement of emitters and corresponding detectors produces a grid of light over the
8 screen. When an operator intersects the grid by inserting their finger or another object therein to
9 penetrate the light grid, the computer subsequently determines the grid location of the intersection.
10 Of course, the computer could be replaced by hard-wired display electronics or the like. Once an
11 intersection is detected, the grid intersection information is correlated to a control algorithm with
12 subsequent process activity.

13 This sophisticated control system is in widespread use and it has proven resilient in most
14 environments. However, a problem has arisen with respect to the use of such systems in the
15 exceptionally harsh operating environments, for example those of large food processing plants and
16 particularly plants processing poultry and the like. These automated control systems are subject to
17 various foreign objects including the processed food items, grease, moisture, corrosive
18 contaminants, and liquids including especially water and harsh cleaning solutions.

19 As will be appreciated by those skilled in the art, contamination of the display and/or display
20 cover is particularly a problem in computer systems that use touch input. The operator constantly
21 touches the device during normal operations and many such touches are not soft as they often occur
22 during situations where speed of control and adjustment to the process are critical and operator
23 stress is correspondingly elevated.

24 Moreover, in the food processing industries, the processing equipment including the sensor
25 control screens are cleaned regularly, normally on a daily basis. Such cleaning often subjects the
26 touch screen to prolonged exposure to various cleaning fluids, liquids and/or solutions. The

1 cleaning fluids can cause additional reactions with the display elements. Even more destructive is
2 the use of high pressure water/cleaning fluid solutions directly upon the display element including all
3 of its periphery.

4 As can be imagined, a permanent liquid tight seal is required to shield the internal sensitive
5 electronic display elements from exposure and destruction by these forces.

6 Prior art techniques have attempted to solve this problem in several ways. Multiple gaskets
7 between the lens filter and the machine cover and housing have been attempted to address the
8 leakage problem. However, even multiple gaskets can leak after exposure to harsh cleaning fluids
9 and the additional assembly steps required for extra gaskets can be time-consuming. The use of
10 multiple gaskets can also require multiple operations and parts which can make front covers using
11 such gaskets more expensive to manufacture. Exposed gaskets also can leak after a relatively short
12 period of time due to the expansion and contraction of the gasket itself due to temperature changes
13 in the environment and exposure of the gasket material to the harsh cleaning chemicals and high
14 pressure cleaning solutions normally used in food processing plants.

15 Another attempted solution involves using a transparent polycarbonate material. Such
16 material is fused to a plastic cover by injection molding and then mechanically mated with a glass or
17 other transparent material as the rear viewscreen. These devices are subject to failure in the harsh
18 operating environments of food processing plants as well. Varying thermal expansion and
19 contraction rates for the various components causes them to eventually warp and distort or crack.
20 Consequently, a watertight seal is often impossible to maintain and fluid penetration of the cover
21 invariably occurs.

22 Thus, a need exists for an improved, unitary lens for a touch sensing device that effectively
23 resists short bursts of high pressure cleaning solutions, harsh chemicals and caustic conditions while
24 maintaining a sufficient level of protection for sensitive internal components.

25 SUMMARY OF THE INVENTION

26 In accordance with one exemplary embodiment of the present invention, a durable unitary

1 shielding lens is provided for use with a responsive display device for associated control process
2 equipment where the operator may manipulate the equipment through the responsive display device,
3 which device may include touch sensitive devices, optical devices, acoustic devices and the like. In
4 one exemplary embodiment, a touch sensitive display device is used, which device includes a display
5 such as a cathode ray tube (crt) or liquid crystal display (lcd).

6 A front cover captivates the unitary lens filter. The lens filter includes a frame with an
7 integral mounting bezel that supports an integral reinforcing lens peripherally abutting and
8 supporting a substantially transparent rear filter behind which a conventional crt, lcd or similar
9 display may be viewed. In typical installations, the crt or lcd displays process information and the
10 like.

11 The front cover captivates the interior bezel to secure the lens to an associated control
12 process device housing such as a conventional form, fill and seal machine used in some food
13 processing lines. The front cover is penetrated by several screws, bolts or similar fasteners that
14 secure it to the machine. The front cover is preferably of metal or a similar rigid construction. The
15 front cover compressibly captivates the assembly to the machine housing to secure the lens filter
16 thereto in a sealed fashion.

17 The entire lens filter may preferably be molded or otherwise formed (vacuum forming is
18 possible) from a hard setting polycarbonate composition including glass fibers or another semi-rigid
19 material. The lens filter bezel seats between the front cover and the machine or the back cover if
20 pendant mounted. A gasket or a similar structure may be provided at the juncture between the
21 front cover and the bezel to prevent water entry therein. The integral rear lens filter is setoff from
22 the bezel inwardly and rearwardly by the reinforcing lens or collar to promote efficient water
23 departure from the rear lens filter. The bezel periphery extends beyond the outermost peripheral
24 edge of the rear lens to dissipate forces exerted thereon.

25 A support assembly including the front cover and an internal lens retainer permits the
26 installation of the lens filter to the machine to be compressible to seal the junction. The front cover

1 and lens retainer captivate the lens filter therebetween to secure the assembly to the machine.

2 The unitary lens filter thus provides a mechanical lock that prevents liquids from seeping or
3 entering from the front and thereby protects the touch sensitive display device and the internal
4 components of the associated process control equipment. The lens filter is durable and preferably of
5 unitary construction and molded simultaneously.

6 Thus, a principal object of the present invention to provide a unitary lens that protects a
7 process control device from destruction by water penetration during high pressure exposure.

8 Another object of the present invention is to provide an assembly that is easily attachable to
9 a touch sensitive display device for use therewith.

10 Yet another object of the present invention to provide a unitary lens filter that is easier to
11 manufacture.

12 Another object of the present invention is to provide a protective cover that resists thermal
13 expansion and contraction due to ambient temperature changes without deleterious deformations
14 while also maintaining an effective seal to prevent contamination.

15 Yet another object of the present invention is to provide a lens filter and retention assembly
16 permitting the user to compressibly seat the lens filter to an associated machine to ensure an
17 impenetrable seal therebetween.

18 A further object of the present invention is to provide a front cover that provides a liquid
19 tight seal even when exposed to streams of high pressure water.

20 An object of the present invention is to provide a cover that is easily cleaned.

21 Another object of the present invention is to provide a unitary molded lens filter that is
22 easier to manufacture than gaskets or joined parts that may require secondary operations like
23 trimming and finishing.

24 These and other objects and advantages of the present invention, along with features of
25 novelty appurtenant thereto, will appear or become apparent in the course of the descriptive
26 sections.

BRIEF DESCRIPTION OF THE DRAWINGS

In the following drawings, which form a part of the specification and which are to be construed in conjunction therewith, and in which like reference numerals have been employed throughout wherever possible to indicate like parts in the various views:

FIGURE 1 is an environmental view showing an embodiment of the unitary molded lens filter for touch screen interface in accordance with the present invention;

FIGURE 2 is a perspective view taken generally from the front thereof;

FIGURE 3 is a front elevational view thereof;

FIGURE 4 is a side elevational view thereof;

FIGURE 5 is a rear elevational view thereof;

FIGURE 6 is a top plan view thereof; and,

FIGURE 7 is a partial cross-sectional view thereof taken along line 7-7 of Figure 6.

DETAILED DESCRIPTION OF THE INVENTION

As can be seen in Figures 1-7, one exemplary embodiment of the present invention encompassing an unitary molded lens filter for a touch screen interface is generally designated by reference numeral 20. The lens filter 20 provides a durable shielding lens for use with an associated control process machine 22 with sensitive internal electronic circuitry.

In one exemplary embodiment, the machine 22 includes a conventional computer including a microprocessor, associated electrical circuitry and a display device to communicate process information to an operator.

The machine 22 preferably utilizes a touch sensitive display device 30 in a housing 24 with an central access port through which an operator 25 can monitor and control the machine 22 with the insertion of a finger 26 or the like into the access port 28 (Fig. 1). Of course, other types of sensing devices are known to those skilled in the art and such sensing devices could be alternatively employed and those skilled in the art will understand that such is within the scope of the present invention.

1 The touch sensitive display device 30 preferentially includes an interior display 32, such as a
 2 cathode ray tube (crt) or liquid crystal display (lcd) or other conventional display device. The
 3 display 32 exhibits various control information 33 for the operator 25 to review in order to
 4 determine when to interact with the machine 22 to change an operating parameter 34, 36 by
 5 touching the screen. For example, the display may show the temperature (box indicated by
 6 reference numeral 33) at which the machine is operating and the operator may control the
 7 temperature by touching a portion of the screen to either raise the temperature (box indicated by
 8 reference numeral 34) or lower the temperature (box indicated by reference numeral 36). Many
 9 modern industrial process machines are controlled in such a manner in most conventional food
 10 processing plants.

11 The display device 30 includes the display 32 along with an adjacent receptor, such as touch
 12 sensitive device or sensor 35. Sensor 35 can include acoustic, optical, or similar emitting and
 13 receiving arrangements that are adapted to receive operator control input. The sensor 35 includes a
 14 parallelepiped frame that defines an open center. Upon the top and an adjacent side of the frame
 15 are mounted banks of radiation emitters 38, preferably infrared although other conventional sensing
 16 devices could be employed such as acoustic wave emitter, mechanical touch sensor or the like, and
 17 oppositely, on the bottom and the other side, are mounted corresponding banks of receivers. The
 18 banks of emitters project a constant rectangular grid to the banks of receivers. The operator
 19 manipulates control input by inserting an object, such as finger 26, into the grid to interrupt the
 20 reception of a particular group of receivers. Such interruption is subsequently correlated into a
 21 control instruction by the sensor and appropriate control signals are then transmitted to the
 22 associated machine 22 for subsequent action thereby.

23 The display device 30 is shielded from contaminants and other destructive forces by a front
 24 cover 40 that captivates a protective lens filter 60 against an internal lens retainer assembly 50. The
 25 front cover 40 also secures the entire lens filter assembly 60 to the machine housing 24.

26 The lens retainer assembly 50 includes a generally parallelepiped frame 52 defining a top 54

1 and a spaced apart bottom 56 (Fig. 7). The top includes an inner ledge 55 adapted to seat a
2 portion of the lens 60. The bottom includes a plurality of holes 57 through which screws, bolts or
3 the like penetrate to secure the retainer 50 to the front cover 40. Thus, the retainer 50 may be
4 tightened by the bolts against front cover 40 as necessary to seat and seal the lens 60.

5 The frame 52 further supports the display 32 using conventional mounting screws, bolts or
6 the like along with appropriate isolation washers and the like. The frame 52 defines an inner port
7 58 coaxially aligned with the central port 28 through which the user may view the display 32.

8 As mentioned previously, the front cover 40 secures the lens 60 to an associated control
9 process device such as a conventional form, fill and seal machine used in some food processing
10 lines. The front cover 40 includes a frame 42. The front cover 40 is penetrated at a rear surface 46
11 by several bolts 47, screws or similar fasteners that secure in threaded hole 44 to couple it to the
12 machine housing 24. The front cover is preferably of singular construction from metal or some
13 other rigid material. The front cover has a rectangular cross-section that defines an inner, central
14 port 48 that is preferably coaxially aligned with central port 28. The central port 48 permits the
15 operator 25 to view display information 33 and interact with the touch sensitive device (i.e. 34 or
16 36) protected by lens filter 60.

17 The lens filter 60 includes an exterior frame 62. Frame 62 is approximately 0.25 to 0.5
18 inches in width and 0.125 to 0.25 inches in thickness. Frame 65 has a generally rectangular cross-
19 section that defines a central port 68. When installed on a machine 22, the central port 68 is aligned
20 with the central port 28. Frame 62 also includes an inside edge 64 and an outer edge 66. Outer
21 edge 66 integrally mounts to a hidden bezel 70, shown in Figure 7.

22 The mounting bezel 70 supports the frame 65 and the peripheral lens that also acts as an
23 intermediate reinforcing collar 80 and an integral substantially transparent rear lens filter 90. The
24 lens filter bezel 70 seats between the front cover 40 and the lens retainer 50.

25 The mounting bezel 70 includes a body 72 with an inner top 74 and an outer peripheral
26 bottom 76 that is approximately 2 inches in width and approximately 0.125 inches in thickness. At

1 its outermost peripheral edge, a small lip 77 projects rearwardly from the periphery 76. The bezel
2 periphery 76 is somewhat thicker than the bezel and its thickness approaches 0.365 inches while the
3 lip 76 is thicker still by approximately 0.125 inches. A rear surface 75 is adjacent the sensor 30.

4 A gasket 79 or similar structure is provided at the juncture between the bezel periphery 76
5 and the inner edge of the front cover 40 to cushion compressive forces therebetween. An optional
6 gasket may also be included between the bezel front 72 adjacent the lens bottom 66 and the cover
7 body 42 to prevent contaminant (such as liquids including water) entry therebetween as well. In
8 some situations, it is sufficient to retain a mold flashing to serve as a gasket or an edgemost lip 77
9 that extends about the bezel periphery 76 can be utilized as a gasket.

10 The bezel periphery 76 extends substantially beyond the outermost peripheral edge of the
11 lens collar 80 and the rear lens filter 90 to dissipate forces exerted thereon as well. Thus, the bezel
12 70 transfers forces exerted on the lens 80 and filter 90 to the housing 24 through the lens retainer
13 50 and the front cover 40.

14 The integral rear lens filter 90 is setoff from the bezel 70 and frame 62 inwardly and
15 rearwardly by the integral reinforcing lens or collar 80. Collar 80 promotes efficient water
16 departure from the rear lens 90. Collar 80 includes a body 85 inclined from the rear lens front 94
17 toward the frame body inside edge 62. Body 85 includes an inner edge 82 and an outer edge 84.
18 The collar 80 has a generally rectangular cross-section that is approximately 0.1 to 0.25 inches in
19 width and approximately 0.25 to 0.5 inches in depth. The collar 80 supports the rear lens 90.

20 Lens 90 includes a body 95 with an outer surface 94 bordering the lens periphery about the
21 body 95. The body 95 also has an outer flat and substantially transparent front face 96 that is
22 approximately 0.125 to 0.5 inches in thickness. Front face 96 protects the internal components of
23 the machine 22 while permitting the operator to view therethrough. Front face 96 thus covers a
24 conventional crt, lcd or similar display 32 may be viewed therethrough. Front face 96 may be
25 polarized or otherwise filter the output of the display 32 as well.

26 As mentioned previously, in typical installations the crt or lcd displays process information

33 as well as control parameters 34, 36. Thus, the length and height of the front face 96 is dependent upon the measure of the access port 28 but they normally approach six inches by eight inches.

The entire lens filter 60 is preferably molded from a hard setting polycarbonate composition including glass fibers simultaneously. The unitary lens filter 60 thus provides a mechanical lock that prevents liquids from seeping or entering from the front of the machine housing 24 through access port 28 and thereby protects the touch sensitive display device 30 and the other internal components of the associated process control equipment 22.

Moreover, as discussed previously, the lens filter is compressibly seated by the coupling of the internal retainer 50 to the front cover 40. Thus, during installation of the lens filter 60 on equipment 22, the filter 60 may be seated and sealed by tightening the bolts, screws or other retention devices coupling the retainer 50 to the front cover 40 as necessary to prevent undesirable contaminant infiltration.

From the foregoing, it will be seen that this invention is one well adapted to obtain all the ends and objects herein set forth, together with other advantages which are inherent to the structure.

It will be understood that certain features and subcombinations are of utility and may be employed without reference to other features and subcombinations. This is contemplated by and is within the scope of the claims.

As many possible embodiments may be made of the invention without departing from the scope thereof, it is to be understood that all matter herein set forth or shown in the accompanying drawings is to be interpreted as illustrative and not in a limiting sense.